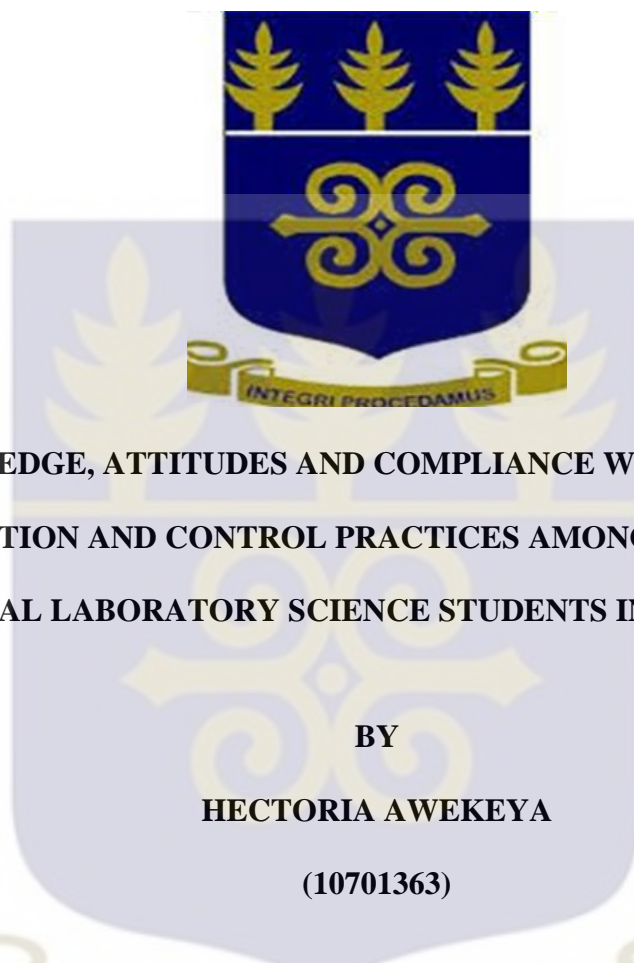


**SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA**



**KNOWLEDGE, ATTITUDES AND COMPLIANCE WITH INFECTION
PREVENTION AND CONTROL PRACTICES AMONG NURSING AND
MEDICAL LABORATORY SCIENCE STUDENTS IN KOFORIDUA.**

**BY
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**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA
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AWARD OF MASTER OF PUBLIC HEALTH (MPH) DEGREE**

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DECLARATION

I, **Hectoria Awekeya** hereby declare that, apart from specific references which have been duly acknowledged, this work is the result of my own work produced from research under the supervision of Dr. Adolphina Addo-Lartey and that it has not been presented in whole or part elsewhere.

.....

Hectoria Awekeya
(Student)

.....

DATE

.....

Dr. Adolphina Addo-Lartey
(Academic Supervisor)

.....

DATE

DEDICATION

To my dear husband, Dr. Francis V. Wuobar and to my two sons Suntaa and Zunuo for their prayers, understanding and support. God bless and keep you all.

ACKNOWLEDGMENT

I wish to express my profound gratitude to God Almighty for his grace strength throughout this programme. This work would not have been completed without the timely contributions and inputs of various people.

I am grateful to my academic supervisor, Dr. Adolphina Addo-Lartey for her guidance throughout the study. I appreciate the insightful suggestions and contributions of Dr. Basil Kaburi and Mr. Anthony Godi. I would also extend my gratitude to all lecturers of School of Public Health who in diverse ways made my stay in the School a memorable one.

I would like to thank Mr. George Ansong and the team for their support during the data collection period.

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ABSTRACT

Introduction: There is a huge burden of Health care associated infections (HAIs) globally; in 2002, there was an estimated 99,000 deaths due to HAIs in the United States and majority of these are attributed to poor compliance of health care workers including health sciences students to Infection Prevention and Control protocols (IPC). Health science students by virtue of their training are at risks of spreading or contracting HAIs due to lack of knowledge and in-experience.

Method: An analytical cross-sectional study was undertaken in two tertiary institutions in Koforidua, Eastern Region. A total of 252 nursing students from the Nursing and Midwifery Training College, Koforidua and 122 medical laboratory science (MLS) were assessed on their knowledge, attitudes and compliance to IPC measures. Data was collected using a structured questionnaire to assess students' knowledge, attitudes and compliance on elements of IPC. Scores were calculated in percentages and differences in scores among both categories made. Associations between knowledge, attitudes, and compliance and the independent variables was also determined through logistic linear regression. A p value <0.05 was considered as significant.

Results: A total 354 out of 374 students had complete data with a response rate of 94.7%. More than half (232/354) were nursing students and 34.5% (122/354) being medical laboratory science (MLS) students. On Average knowledge scores were poor, 44.7%, attitude scores were satisfactory, 80.9% and compliance rates were satisfactory, 88.8% respectively. Third year students on average performed better with knowledge scores of 49.2% compared to second and first year students with 43.2% and 40.4% respectively. Again, third year students had higher attitude scores, 82.3% compared to second and first

year students with scores of 80.4% and 78.0% respectively. These scores were statistically significant, p value <0.05 . Female students were also reported to be significantly more compliant (89.6%) with IPC practices than their male counterparts (86.3%), p value <0.05 . There was however no significant difference in knowledge scores of MLS or nursing students.

Conclusion: Both student groups had poor knowledge in IPC but reported positive attitudes and satisfactory compliance rates. Effective and continuous teaching and learning of IPC throughout the years of study both in the classroom and during clinical rotation will help improve knowledge as well attitudes and compliance of students.

Keywords: Knowledge, attitude, compliance, infection prevention and control, healthcare trainees, Koforidua.

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LISTS OF ABBREVIATIONS

AIDS	-	Acquired Immune Deficiency Syndrome
APIC	-	Association for Professionals in Infection Control and Epidemiology
CDC	-	Centre for Disease Control and Prevention
ERC	-	Ethics Review Committee
GHS	-	Ghana Health Service
HAIs	-	Health Care Associated Infections
HCW	-	Healthcare Worker
HSS	-	HIV Sentinel Surveillance
IPC	-	Infection Prevention and Control
KTU	-	Koforidua Technical University
MLS	-	Medical laboratory science students
MOH	-	Ministry Of Health
NES	-	Nursing Education Stakeholders
NMTC	-	Nursing and Midwifery Training College
NS	-	Nursing students
PPE	-	Personal Protective Equipment.
WHO	-	World Health Organization

LIST OF DEFINITIONS

Infection prevention and control:

Refers to measures aimed at minimizing and stopping transmission of infections in health care settings.

Health care associated infections:

These are infections people get while assessing healthcare for other conditions.

Healthcare settings:

These are places where healthcare is offered. It includes but not limited to hospitals, polyclinics, health centers, veterinary clinics and laboratories.

Healthcare waste:

These are by-product of healthcare delivery. They include both solid and liquid waste

Knowledge:

Facts, information and skills acquired through experience or education

Attitude:

This is a settled way of thinking or feeling about something

Compliance

The action of conforming to a command

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Healthcare Associated Infections (HAIs) are a huge burden in our world today. In 2002, there was an estimated 99,000 deaths due to HAIs in the United States alone with the government spending over \$20 billion in cost (Almeida, 2015). HAIs vary from specialty to specialty depending on the kind of service offered and are they are mostly as a result of lack of compliance with standard precautions. These services include surgical, medical, urological, obstetric, paediatric and dental. The common types of HAIs in sub Saharan Africa are surgical site infections whereas urinary and respiratory tract infections are common in developed countries (Rothe et al, 2013).

These infections may be from bacteria such as staphylococcus aureus, enterococci, and viruses such as Rhino viruses, HIV, Hepatitis B and Hepatitis C. Infection and Prevention Control (IPC) protocols were designed to reduce the risks of spread of HAIs in health care settings, thus protecting both the patient and the healthcare worker (MOH, 2015). Strict adherence to these protocols have proven to reduce drastically the risks of HAIs in many healthcare settings. In recent times, loss of HCWs to the outbreak of deadly diseases such as Ebola virus disease calls for health workers to know and to strictly comply with IPC measures (Almeida, 2015).

World Health Organization (WHO) estimates that more than 2 billion people worldwide are exposed to hepatitis B virus and out of this number, more than 350 million people are

living with chronic hepatitis B infection with no physical signs of ill health (Rufai, Mutocheluh, Kwarteng, & Dogbe, 2014). In Ghana, the national prevalence of hepatitis B is about 11% and as high as 13% among blood donors (Rufai et al., 2014). Again, the national prevalence for HIV in Ghana is 2.1 % (GAC, 2018) hence the need for HCWs to apply standard precautions to all patients.

Non adherence to standard protocols range from minor to grave consequences such as longer stays in hospitals, increased cost of healthcare, loss of productivity and working hours, loss of wages, loss of jobs and death (<https://www.passenlaw.com/consequences-hospital-acquired-infections/>). HAIs may also lead to legal suits against hospital staff and the facilities (Kingston, O'Connell, & Dunne, 2018). The European Union (EU) estimates that at least 25,000 persons die annually from multidrug resistant microorganisms' infections with an approximated overhead cost of 1.5billion Euros. Similarly, in the United States of America, 1 in 25 hospital patients are estimated to develop at least one HAI and the US government spends about 9.8 billion dollars on common HAIs annually (www.cdc.gov/winnablebattles/report/HAIs).

Again, a study done to assess the incidence of TB among health care workers worldwide revealed that health care workers are averagely at higher risks of developing tuberculosis as a result of exposure at work places. The good news is that, there is evidence to support that incidence can be greatly reduced if health facility administrators strongly commit and champion the cause of prevention of exposures at work places through supply of adequate resources such as personal protective equipment like N95 respirators, surgical, and medical face masks (Baussano et al., 2012).

Several factors account for poor compliance of healthcare workers to IPC protocols. Among them is, inadequate quality of education given at the training schools including universities, medical and nursing schools (Cheung et al., 2015). In order to forestall this, it is important that from the very start of their education, healthcare professionals' knowledge and competencies in IPC be strongly established and followed through each academic year until the completion of the various studies. One critical point to help protect students from the risks of HAI is through adequate knowledge from well-trained Infection Prevention tutors or instructors before and during their clinical placements (Tavolacci et al., 2008). Frequent assessment of knowledge and practices of students in IPC has also proven to improve students' attitudes and further compliance to standard IPC protocols in clinical settings (Darawad & Al-Hussami, 2013).

Although every part of the disease transmission chain can be delinked, the easiest and most practical point for most infections is at the mode of transmission point, where IPC measures are effective and appropriate (MOH, 2015). This study therefore sought to assess the knowledge, attitudes and compliance to IPC measures of students who are an integral part of healthcare delivery.

1.2 PROBLEM STATEMENT

The world Health Organization estimates that in low and middle income countries, approximately 90% of healthcare workers are not compliant with hand hygiene guidelines, with an approximate 20% surgical site infections occurring post caesarean deliveries. One in every fifteen patient on admission develops one form or the other of HAIs, many of which are preventable through strict adherence to IPC protocols (World Health Organization, n.d.).

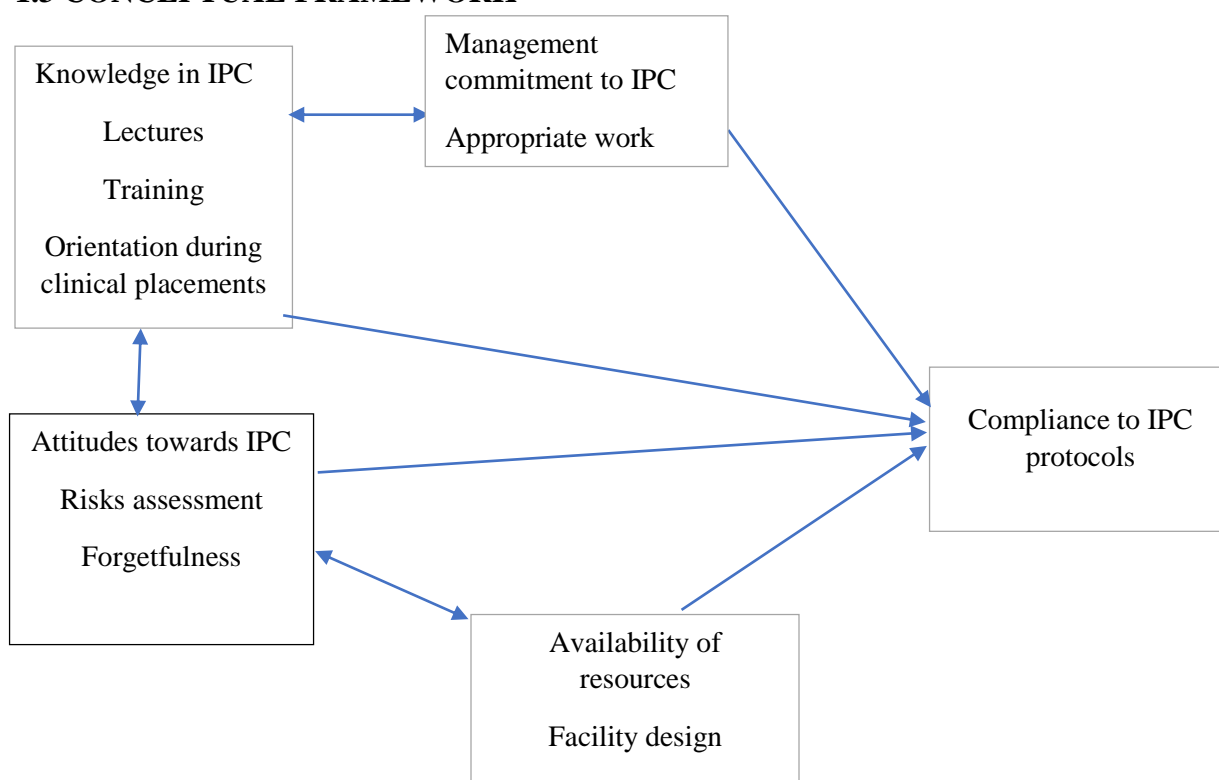
Before the inception of the germ theory, Dr. Ignaz Semmelweis in 1847 effectively demonstrated that the hands of healthcare workers including trainees contained infectious agents that made patients worse than they were before entering into health facilities. He demonstrated that hand washing was one sure way to decrease infectious particles on the hands of healthcare workers and consequently save lives (Smith, Watkins, & Hewlett, 2012). In spite of this evidence, many health workers and trainees do not comply effectively with hand hygiene practices today (Aiello, Larson, & Sedlak, 2008).

Many factors are reported to be accountable for the poor knowledge, attitudes and compliance to infection prevention measures. Some studies have reported poor knowledge and understanding of the principles of IPC, forgetfulness, heavy workload, inadequate staff strength, non-availability of resources, skin irritation, general poor attitude and low commitment of staff and managers towards IPC (Ojulung, Kh, & Sn, 2013) (Hayeh & Esena, 2013) (Ravichandran, Leela, Ravinder, & Kavitha, 2019) (Kingston et al., 2018). Some studies have also shown that poor organization of the work environment coupled with poor enforcement of standards result in lack of adherence to the use of personal protective equipment (Carneiro, Neves, Custódia, Medeiros, & Munari, 2011).

Non-adherence to IPC by healthcare workers and students has its effects not only on patients but also on students and HCWs themselves. Poor compliance to IPC result in increased risks of injuries and of spread of HAIs among healthcare workers, patients, visitors and the community at large (Nejad, Allegranzi, Syed, Ellisc, & Pittetd, 2011). For example, out of 1,144 needle stick injuries reported in a Chinese hospital, 100% of them were nursing students with each student getting an average of 4.65 needle stick injuries (Yao et al., 2010). Also, about 10% of health care workers with HIV and approximately

37% of health care workers with Hepatitis B are related to accidental exposures to patient body fluids at work (Cheung et al., 2015). In addition, HAIs lead to overdependence on antibiotic use, which result in antibiotic resistance, prolonged hospital stay and loss of confidence in health system and increased cost of healthcare as captured in the working paper on multisectoral coordination against antibiotic resistance (WHO, 2018).

1.3 CONCEPTUAL FRAMEWORK



1.4 JUSTIFICATION

Few studies have been conducted in Africa and the sub-Saharan region on the knowledge, attitudes, and compliance of health science students in IPC. In order to reduce the risks of HAIs among health care workers and students of health sciences, Infection Prevention and Control (IPC) practices must be strictly adhered to since effective IPC practices have been

proven to reduce HAIs by more than 30% (WHO, 2017). These also come at lower cost in terms of money and time to the individual and the institution / facility of care and training. The Eastern region has had the highest prevalence of HIV in the last decade, hence it is important for healthcare workers and students to adhere strictly to standard precautions of infection prevention and control.

Again, there is no available data on IPC practices among health science students in Koforidua, the Eastern regional capital where this study was carried out. Anecdotal evidence among medical laboratory science and nursing students who have their clinical rotations in the Eastern Regional Hospital show poor knowledge and adherence to standard IPC protocols (Unpublished source). Thus, this study sought to document the students' knowledge, attitudes and compliance with IPC practices which could provide useful information that would serve as the baseline upon which future research would be carried out.

The findings of this study will also contribute to a broader understanding of IPC among health science students in general and nursing and medical laboratory science students in particular in Ghana.

1.5 RESEARCH QUESTIONS

1. What are the knowledge levels of nursing and medical laboratory science students in IPC?
2. What attitudes do nursing and medical laboratory science students have towards IPC?
3. What is the compliance rate of nursing and medical laboratory science students to IPC protocols?

1.6 GENERAL OBJECTIVE

To assess the knowledge, attitudes and compliance of nursing and medical laboratory science students to IPC protocols.

1.7 SPECIFIC OBJECTIVES

1. To assess the knowledge of nursing and medical laboratory science students on IPC practices
2. To assess the attitudes of nursing and medical laboratory science students towards IPC practices
3. To evaluate the compliance rates of nursing and medical laboratory science students with IPC practices

CHAPTER TWO
LITERATURE REVIEW

**KNOWLEDGE, ATTITUDES AND COMPLIANCE OF HEALTH CARE
WORKERS AND HEALTH SCIENCES STUDENTS TO IPC**

2.1 INTRODUCTION

Infection prevention and control (IPC) measures are key to quality and safe care for all categories of patients in all settings, both resource rich and resource limited environments (<https://www.who.int/infection-prevention/about/ipc/en/>). IPC practices are designed to protect the healthcare worker from harm in the line of duty. They are based on twelve basic set of standard precautions. These are hand hygiene, proper use and removal of personal protective equipment (PPE) like examination gloves and aprons, proper patient placement, right processing of used equipment and proper environmental cleaning, disinfection and control.

The other minimum precautions that must be applied by all healthcare workers and students in handling all manner of patients are proper health care waste (both solids and liquids) management, safe injection practices and aseptic techniques as well as safe handling and disposal of sharps. The others include Occupational health and safety, proper and safe handling of soiled linen and laundry, right and safe handling and transportation of clinical specimens and observing respiratory hygiene/cough etiquette (MOH, 2015).

2.1.1 Knowledge of IPC among health science students in resource limited settings

For many years' health sciences students, nursing students inclusive have received their practical training in hospitals. These periods known also as clinical years or sessions expose these students to services and conditions of patients which increase their risks of acquiring or spreading Health Care Associated Infection as they form part of service delivery teams. Effective and well managed clinical years contribute greatly to the quality of nurses graduated out and for that matter improve patient care and output (The Nursing Education Stakeholders (NES)-Group, 2012). Usually, students are at higher risks of HAIs compared to HCWs during clinical rotations in health facilities mainly because of lack of experience and adequate knowledge in IPC. This lack of knowledge may be attributed to several factors including deficits in teaching and learning of IPC during course work (Al-Hussami & Darawad, 2013).

Studies unearthing health sciences students' knowledge in IPC has produced mixed results. While some have shown relatively higher levels of knowledge with better records among nursing students compared to medical students, others have demonstrated poor knowledge of students in the principles of IPC. This has affected their levels of compliance.

For instance, there were suboptimal knowledge scores recorded among medical, radiology and nursing students of the University of Namibia in infection prevention and control. Medical students however recorded better scores than nursing and radiology students. This the students attributed to inability of the school to start IPC lessons early enough during their training (Ojulong et al., 2013).

There is a high risk of cross infection with Hepatitis B and C during dental treatment. Dentists and dental students are therefore expected to reduce these risks through the adherence to IPC methods such as use of personal protective equipment like gloves, goggles, face shields and proper hand hygiene practices. Despite these risks, dental students in Central India were reported to have poor knowledge in IPC practices (Singh & Gupta, 2011).

2.1.2 Knowledge of health sciences students in IPC in resource rich settings

Despite the availability of adequate IPC logistics in these settings, studies have produced in most cases, suboptimal knowledge in IPC. Among medical and nursing students in Greece, Australia and Sweden, knowledge in IPC had many influencers. These include frequency of knowledge based assessments and modes of teaching and learning of the subject. Students with higher knowledge scores were those who had more than one method of teaching and learning as well as were frequently assessed (Mortel et al., 2011).

In addition, knowledge in infection prevention and control among Stomatology students in Lima Peru, also revealed an inadequate level of knowledge (Silva, Palomino, Robles, Jorge, & Mayta-tovalino, 2018). Similarly, students and faculty members of the dental faculty in Saudi Arabia revealed very low knowledge scores of 49% and 49.6% respectively in IPC (Alharbi, Shono, Alballaa, & Aloufi, 2019).

2.1.3 Knowledge of healthcare workers in IPC in Ghana

The hands of HCWs are easily contaminated by disease causing organisms such as bacteria, viruses and bacterial spores. Some of these contaminants stay longer on their hands and may be the source of diseases in healthcare settings, hence it is important for health care workers to understand the basic practices of IPC (Landelle et al., 2014). The situation in

Ghana is of a mixed picture. Healthcare workers at the Ridge Hospital in Accra, Ghana, exhibited moderate knowledge although they had some facility based training (Hayeh & Esena, 2013). Again, healthcare workers in Lower Manya Krobo of the Eastern region reported poor knowledge levels in standard precautions (Akagbo, Nortey, & Ackumey, 2017). Unpublished studies among their colleagues at La General Hospital, Accra, however showed that staff there exhibited excellent level of knowledge in IPC.

In 2018, Institutional Care Division (ICD) of the Ghana Health Service (GHS) in conjunction with USAID Systems for Health conducted a five regional assessment of knowledge and compliance with IPC protocols among health facilities and healthcare workers. These regions were part of a nationwide IPC training of healthcare workers by the Ghana Health service, Systems for health and Jhpiego after initial assessment showed a general poor knowledge and compliance with IPC among health workers. The follow up monitoring showed an improvement in the knowledge of health workers. Although knowledge had improved, there were still challenges with compliance (Ghana Health Service, 2018).

2.1.4 Knowledge of Hand hygiene among health science students

Hand hygiene practices are the practices that help keep hands clean of dirt and contamination. There are four types of hand hygiene practices. They are social hand washing, antiseptic hand washing, surgical hand scrub and alcohol hand rubbing. Each of these four types are indicated at various levels of care to minimize risks of disease transmission (MOH, 2015). The recommendation now is for all healthcare workers to use alcohol hand rubs during routine health delivery if hands are not visibly soiled. It is fast, convenient, cheaper and cause less skin irritation compared with frequent hand washing

which is bedeviled with problems such as non-availability of running water, soap and sinks. Hand washing practices are therefore reserved for times when hands are visibly soiled such as after body fluid exposure (WHO, 2009). A randomized study on the best hand hygiene method in outbreaks such Ebola however showed that there was no significant difference in using either alcohol hand rubs, soap or 0.05% chlorine solution for hand hygiene (Wolfe et al., 2017).

For optimal compliance with hand hygiene, WHO introduced “my five moments of hand hygiene” during the Save lives; clean your hands initiative in 2009. All health workers are expected to observe these moments to reduce high level of HAIs. These are, before touching a patient, before aseptic or clean procedures, after body fluid exposure risks, after touching a patient, and after touching patient surroundings (Sax et al, 2007). These moments were introduced to help with easy training, monitoring and compliance to hand hygiene. Knowledge of nursing staff and students in Karad, India on the moments of hand hygiene were moderate, although nursing students had better scores than staff (Shinde & Mohite, 2014).

A systematic review of students’ knowledge in hand hygiene showed low to moderate knowledge and the recommendations to improve knowledge was by using multimodal levels of training and teaching, scenario-based hand hygiene simulations during course work and mentoring students in hand hygiene during clinical rotations (Labrague & Mckenroe-petite, 2017).

2.1.5 Knowledge of healthcare students in Personal Protective equipment

Personal protective equipment are protective clothes and equipment that are worn to prevent or reduce injury. In health settings PPEs offer the wearer protection against

potential infectious agents during health delivery (MOH, 2015). Examples of PPEs are examination gloves, surgical gloves, surgical face masks, coats and aprons. The choice of PPEs are dependent on the risks at stake. Because of this, healthcare workers have high tendency of not adequately and appropriately using PPEs due to the poor risks assessment. Doctors, nurses and technicians reported poor knowledge of PPEs in a study conducted in Tamil Nadu, India (Archana Lakshmi, Gladius Jennifer, Meriton, & Paul, 2018).

2.1.6 Knowledge in sharps management

Healthcare workers are at risks of contracting blood borne diseases such as HIV and hepatitis B in the line of duty through cuts and pricks from blades and needles. In order to reduce these risks, the WHO has prescribed some standard safety guidelines in handling sharps. The guidelines admonish health workers not to manipulate sharps in anyway after use. These include avoiding recapping, bending, breaking, or removal of used needles from syringes. In situations where recapping cannot be avoided the “one hand technique” is recommended. All sharps are to be disposed of in rigid puncture resistant sharps containers which must be well labeled with the international biohazard symbol. Again, sharps just like other waste must be segregated at the point of generation and must not be mixed with other waste.

Although these guidelines are available, there are health workers who sustain avoidable sharps injuries due to lack of knowledge (Madeo, 2004). There were about 104 healthcare workers across the world living with HIV in 2002 as a result of exposures at work sites (Cutter & Gammon, 2006).

2.1.7 Knowledge in Healthcare waste management

Health care waste is all waste, both solids and liquids produced as a result of health service delivery (MOH, 2015). Healthcare waste or otherwise termed medical waste may be harmful to persons or the environment. (Hangulu, 2018). The annual global estimation of healthcare waste generated is about ten billion tons with only 10-25% of that being harmful or infectious. When the waste is not properly segregated into these categories, the non-harmful ones become contaminated and pose equal risks to people and the environment just like harmful waste (Mugabi, Hattingh, & Chima, 2018).

If attention is given to the management of waste, proper segregation by healthcare workers can effectively reduce hazardous waste to about 10-25% (Babanyara, Ibrahim, T, Bogoro, & Abubakar, 2013). Knowledge of healthcare waste has been reported to be low in some instances (Olaifa, Govender, & Ross, 2018) and in other instances, healthcare workers had adequate knowledge in waste management (Mugabi et al., 2018).

2.2 ATTITUDE OF HEALTHCARE WORKERS TO IPC

The hands of health care workers may contain many infectious micro -organisms which they may spread from themselves to their colleagues and to patients. These can happen even with seemingly clean procedures (MOH, 2015).

A study of Health workers in Hong Kong showed that staff who had poor attitude towards IPC protocols ended up with poor compliance, thus attitude of health workers and students have a direct correlation to their compliance or otherwise to IPC (Chan, Ho, & Day, 2008). Health workers in Trinidad and Tobago were also reported to have low attitude towards IPC (Unakal et al., 2017). A study conducted in Karad, India; comparing attitudes of nurses

and nursing students to hand hygiene practices showed that nursing students had better attitudes than nurses (Shinde & Mohite, 2014).

In Nigeria, attitude scores among different category of healthcare workers in two tertiary hospitals were relatively good. Comparatively, house officers had lower attitude scores than resident doctors. Medical laboratory scientists and staff nurses had similar attitude scores (Ogoina, Pondei, Chima, Isichei, & Gidado, 2015). Also, there was no significant differences in attitude scores of male and female students in Peru (Silva et al., 2018).

2.2.1 Attitudes of health sciences students towards hand hygiene

In India, postgraduate students and residents in training had poor attitudes towards hand hygiene and this was mainly attributed to lack of hand hygiene training for newly qualified staff (Ravichandran et al., 2019). Nursing students in Ireland had better attitudes towards hand hygiene practices compared to medical students and they agreed that hand hygiene practices contributed to good patient outcome (Kingston et al., 2018).

2.2.2 Attitudes of healthcare workers towards the use of PPEs

Healthcare workers especially surgeons in Saudi Arabia reported low use of double gloves and eye protection with the belief that it was not necessary and there was no evidence to its role in reducing HAIs (Alsaigh et al., 2019).

2.3 Compliance of Healthcare Workers with IPC Practices

Health care workers all over the world face the risk of contracting infectious diseases such as HIV, Hepatitis B through needle stick injuries and splashes during routine healthcare delivery. Adherence to standard precautions of IPC measures has over the years been proven to reduce these risks. Despite the fact that their risk is lowered when they comply with IPC measures, many health workers still do not comply as expected. The reasons

given by non-adherence to IPC measures include lack of adequate knowledge, reduced perceived risks, non-availability of resources, heavy work load and low staffing (Askarian & Malekmakan, 2006).

The role of work experience in compliance to IPC practices was very evident among Brazilian and Hong Kong nurses where nurses with more years at work had better compliance rates than those with few years of experience (Maria et al., 2015).

2.3.1 Compliance to IPC among healthcare workers in resource rich settings

The level of compliance to IPC is varied from countries in resource rich settings with some reporting optimal levels of 90 or more and some reporting suboptimal and satisfactory levels. Among community nurses in the United States, it was observed that compliance was more than 90%. It was worthy of note, knowledge played little in compliance rates of the nurses. What mainly influenced their compliance were their attitudes, facilities acceptable laid down practices as well as the organizational layout (Addelman, 2018).

Unlike in the United States, nurses in Brazil and Hong Kong reported suboptimal levels of compliance to standard precautions despite the formal training given to them. Brazilian nurses however had better compliance rates in more areas than their Hong Kong counterparts (Maria et al., 2015).

Again, the compliance of HCWs to standard precautions in China are reported to be between 9.1% and 73% because they tend to measure their perceived risks before they comply (Cheung et al., 2015).

2.3.2 Compliance of IPC among healthcare workers in resource limited settings

In Ghana, compliance to IPC practices have been reported to be low in a study among healthcare workers at Ridge hospital (Hayeh & Esena, 2013). Following a national training on IPC for healthcare workers, unpublished monitoring report from five regions indicated no significant improvement in compliance rates of health workers to IPC protocols (Ghana Health Service, 2018).

Also, healthcare workers in Trinidad and Tobago exhibited poor compliance rates in IPC practices aimed at reducing HAIs (Unakal et al., 2017). Similarly, healthcare workers in Nigeria were reported to have poor compliance rates with IPC with medical laboratory scientists being the least compliant with IPC protocols (Ogoina et al., 2015).

2.3.3 Compliance of IPC among students in resource rich settings

The practice of hand hygiene among some medical and nursing students in Greece, Switzerland and Australia indicated that, compliance among students was strongly affected by and not limited to frequent knowledge assessment and seriousness attached to the subject by the institutions (Mortel et al., 2011). In Saudi Arabia, dental students in higher years of their training surprisingly had lower compliance rates compared to those in lower years of training (Alharbi et al., 2019). This is worrisome because students in higher clinical years spend more time with patients and are therefore at higher risks of HAIs.

The main source of infection prevention knowledge is in the schools, hence with the seemingly non adherence to IPC protocols among nurses, some studies have questioned the kind of training and instructions given at the training schools on IPC as well as the time dedicated to the teaching and learning of the subject. It is important to note that classroom lectures of IPC have also been heavily criticized as nurse educators and lecturers may concentrate

on theory and not put the instructions into practice hence on the wards students may exhibit poor understanding and practice of IPC (Gould & Drey, 2013).

2.3.4 Compliance among students stratified by sex

Studies show that female students are more compliant with standard precautions than their male colleagues. This may be due to the general principle that females are meticulous and less likely to indulge in risky and unacceptable behaviors (Colet, Cruz, Alotaibi, Colet, & Islam, 2017).

Again in Jordan, female students reported higher levels of compliance compared to their male colleagues whereas a similar study in Australia showed no statistical difference between male and female students in reported compliance (Hassan, 2017).

2.3.5 Compliance to hand hygiene

Medical and nursing students in Ireland were observed to have optimal compliance to the W.H.O third hand hygiene moment, i.e. after body fluid exposure, however had poor compliance to the fifth moment of hand hygiene i.e. after touching patient surroundings (Kingston et al., 2018). Even in the presence of adequate resources, J. Randel et.al in 2010 observed suboptimal levels of compliance among HCWs in UK towards hand hygiene.

Comparatively higher compliance were recorded among allied health workers than nurses and doctors respectively in Nottingham, UK (Randle, Arthur, & Vaughan, 2010). In this study, HCW also exhibited low compliance with the fifth moment of hand hygiene, after touching patient surroundings. Unlike students, healthcare workers scored 100% compliance in the third moment of hand hygiene (before aseptic or clean procedures).

2.3.6 Compliance to the use of PPE

Gloves are common barrier PPEs that are routinely used in health delivery. Studies however show that health workers do not adhere to the proper use of them. For healthcare workers to adhere to IPC measures, they consider many factors including the safety or otherwise of the procedure and the patient, the availability of resources, benefits and even discomfort associated with use (Chan et al., 2008).

Some healthcare workers do not also use the PPEs well. For instance, among HCWs in Tamil Nadu, India; more than half of the doctors observed (237/345) in the use of PPEs were inappropriately using them (Archana Lakshmi et al., 2018). The high attack rate of HCW in outbreaks such as Severe Acute Respiratory Syndrome (SARS) and Ebola virus disease (EVD) has called for healthcare workers to strictly wear and properly remove PPEs. It is important for HCWs to properly and safely remove PPEs because they can be exposed to contamination during removal of used PPEs (Suen et al., 2018). Even in simulation exercises where healthcare workers were actively being filmed, there was high contamination of HCWs and environment (Kang et al., 2017).

Less than 60% of surgeons in Iran had never used double gloves, eye protection or surgical masks during surgeries although hepatitis B prevalence was reported to be between 1% and 5% (Moghimi et al., 2009). Doctors, nurses and laboratory technicians in India were reported to have high levels of improper PPEs use leading to increase risks of exposure to infectious microorganisms such as HIV, hepatitis B and Ebola due to non-availability and lack of importance (Archana Lakshmi et al., 2018).

An international multidisciplinary team of experts after hazard risks assessment of waste management in Ebola treatment centers recommended appropriate use of PPEs and hand hygiene as effective measures of reducing risks (Edmunds et al., 2016).

2.3.7 Compliance to sharp safety

Compliance to standard guidelines of managing sharps have been reported to be low in several studies and summarized in a systematic review by J. Cutter and J. Gammon both of Swansea University. Injuries were reported mainly from overflowing sharp boxes due to non-availability and inadequate sharp boxes (Cutter & Gammon, 2006).

One important way of achieving high compliance to sharp safety management and thus avoiding sharp injuries is to make healthcare workers accountable to each other (Spruce, 2017).

CHAPTER THREE

METHODS

3.1 Study Design

This was an analytic cross-sectional study of knowledge, attitudes and compliance with infection prevention and control practices among nursing and medical laboratory science students of the Nursing and Midwifery Training College and Koforidua Technical University in the New Juaben Municipality conducted between 8th and 25th May, 2019.

3.2 Study Area

Koforidua is in the New Juaben municipality. Koforidua is a vibrant commercial town located in the South –East area of the Eastern Region of Ghana with an estimated population of 2,633,154. The municipality is home to four (4) tertiary institutions namely Koforidua Technical University (KTU), All Nations University College, Seventh Day Adventist college of Education and Nursing and Midwifery Training College (NMTC).

In 1964, the Koforidua Nursing and Midwifery Training College was founded as two Schools of Nursing and School of Midwifery on the same compound to train qualified Registered nurses and midwives. In 2008, the two schools were merged under one headship.

Koforidua technical university was established in 1997 with the vision of producing skilled targeted manpower for the country's industrialization. Since its establishment, it has upheld the mandate of producing skilled personnel in fields such as Allied Health Science under which medical laboratory scientists are trained. Other faculties include Engineering, Business management, Accounting, Marketing and Applied Science and Technology. The

study took place in Koforidua Technical University (KTU) and Nursing and Midwifery Training College (NMTC).

3.3 Study Population

The study involved 252 nursing and midwifery students from NMTC and 122 medical laboratory science students from KTU. The nursing students include 84 first years, 87 second years and 81 third years who had been on clinical rotation at least once. There were 78 second year and 44 third year medical laboratory science students.

3.4 Study Instrument

The questionnaire was composed of sociodemographic characteristics, ten questions assessed students on knowledge in IPC, five questions assessed their attitudes towards to IPC and ten questions assessed their compliance to IPC practices. The knowledge questions were adapted and edited from a previous Infection Prevention and Control training done across Ghana by Jhpiego and Systems for Health in 2016 and also from previous studies done among health sciences students in Namibia (Ojulong et al., 2011) and France (Tavolacci et al., 2008). Questionnaires were then given to students to answer by themselves.

Ten questions on knowledge were scored as correct or incorrect. Correct answers attracted one mark each and incorrect answers attracted zero mark. The marks were then converted to percentages. Thus, the possible scores for knowledge ranged from 0 to 100, with scores more than 90% indicating excellent knowledge, scores between 90% and 75% considered good, between 74% and 50% was considered moderate, while scores less than 50% were considered as poor knowledge.

Five questions on attitudes were adapted from a study done in Trinidad and Tobago among healthcare workers (Unakal et al., 2017). The scores were ordered on a Likert scale as 1=very bad, 2=bad 3=good, 4=very good.

Ten questions on compliance were adapted from a standard precautions scale developed in 2010 in accordance with the Standard Precaution guidelines of the World Health Organization and the Hong Kong Hospital Authority. The responses of students were ordered on a Likert scale as 1=poor 2=sub-optimal 3=satisfactory 4=Optimal. Mean scores were computed for each variable per person on their attitude and compliance scores and also converted to percentages subsequently.

3.5 Study Variables

The outcome variables were knowledge defined as excellent, good, moderate and poor based on a composite score, attitudes and compliance. The independent variables of the study were student groups, year groups, age, sex, religion and educational background.

Table 3.1: Summary of Variables used in the Study

Variable Type	Operationalization	Scale of Measurement
Outcome Variable		
Knowledge	Excellent/Good/moderate/poor	Ordinal
Attitude	Very good/good/bad/very bad	Ordinal
Compliance	Optimal/satisfactory/suboptimal/poor	Ordinal
Independent Variable		
Age	Years	Continuous
Sex	Male, Female	Binary
Student group	Nurse/MLS	Categorical
Year group	1 st /2 nd /3 rd year	Categorical
Religion	Christian, Muslim, Traditional Others	Nominal

3.6 Sampling Method

Students were selected after they were informed about the research with permission from lecturers. In each class, students were asked to pick from a bowl containing yes and no. The yes was equal to the desired number of students to be selected from that class and the no's were the rest of the class size. Students who picked yes were further asked for their consent, written and verbal before questionnaire were administered to them.

3.7 Sample Size Determination

The sample size was calculated using the Cochran formula stated as $n = \frac{(Z^2(pq))}{e^2}$, a prevalence of 67% of knowledge in Infection Prevention and Control was recorded among nursing and radiology students of health sciences in Namibia (Ojulong et al., 2013).

Thus p is 0.67

Non respondent rate of 10%,

N was the population size,

Z is the Z score, p is the prevalence,

q is 1-p,

e is the margin of error or the desire level of precision, 5%, 0.05

n is the minimum sample size

Total number of nursing and medical laboratory science students = 680+330=1010

$$\text{Hence, } n = \frac{(1.96^2(0.33*0.67))}{0.05^2} = \frac{(3.8416*0.2211)}{0.0025} = 339.8$$

Thus, giving a sample size of 340

In order to cater for lost questionnaires, non-response of questionnaires and non-return of filled questionnaires, an additional 10% of the sample size will be added.

$$\text{Non response rate of 10\%} = \frac{10}{100} \times 340 = 34$$

Thus, the expected total sample size will be 34 + 340 = 374

The sample size for each of the two categories was attained by multiplying a constant proportion $\frac{374}{1010} = 0.370297$ by the number of students in each category.

Thus $0.370297 \times 680 = 251.80$ hence 252 nursing students were sampled out of a total of 680 nursing students.

$0.370297 \times 330 = 122.198$, hence 122 laboratory science students were selected out of a total of 330 laboratory science students. A ratio 2:1 was then applied in the selection process.

3.8 Inclusion and Exclusion Criteria

3.8.1 Inclusion Criteria

Students were selected based on two criteria.

1. Students of both institutions who had been on clinical rotation at least once for practical work
2. Gave their consent to partake in the study.

3.8.2 Exclusion Criteria

Students who had not had not been on clinical rotation and those who did not give their consent were excluded from the study.

3.9 Quality Control

3.9.1 Pre-Data Collection

The principal investigator was assisted by one research assistant to administer the pretest questionnaire to students of Savior Nursing Training College. Two more assistants joined

the principal investigator to collect data at the Koforidua NTC and KTU medical laboratory department.

3.9.2 Post-Data Collection

The principal investigator checked for completeness of data. Questionnaire which had incomplete data were discarded. Only forms with complete information were coded and entered for data analysis.

3.10 Data Processing and Analysis

Complete responses were coded and entered into 2010 Microsoft excel spreadsheet after which it was exported into STATA version 15 for analysis. Responses were labeled in STATA variable manager. Knowledge was measured by a set of ten questions on some aspects of standard precautions. A correct answer was given one and a wrong answer was given zero. Attitude was measured by a set of five positive attitudes questions measured on an abridged Likert scale of strongly agree, agree, disagree and strongly disagree. A score of four was given to strongly agree, three to agree, two to disagree and one to strongly disagree. Compliance was measured by nine set of positive questions and one negative response question. The responses scored on a Likert scale of never (one), seldom (two), sometimes (three) and always (four).

Statistical tools such as proportions, percentages, frequency tables, and cross tabulations were used to describe the data. Linear regression and Kruskal –Wallis test were used to compare the interactions between the knowledge, attitudes and compliance of students and the independent variables, student group, year group, sex and educational background. The differences in the dependent variables between the two groups of students were calculated using Kruskal- Wallis tests. Spearman correlation coefficient was used to determine

correlation between knowledge, attitudes and compliance. Statistical significance was determined at p-value of < 0.05 .

3.11 Ethical Considerations

3.11.1 Ethical Approval

Ethical approval was obtained from the Ghana Health Service Ethics Review Committee (GHS-ERC 028/03/19). Introductory letters were sent from the Administrator of the School of Public Health for permission to conduct research among students of NMTC and KTU. Questionnaires were only given to students after informed verbal and written consent was taken from them.

3.11.2 Dissemination of Findings

The results of this research has been submitted to the School of Public Health in partial fulfillment of the requirements for the award of a Master of Public Health Degree. Copies of the findings will also be delivered to the management of the Koforidua Training College and Nursing and Training, Koforidua. Again, findings of the study will be written for publication in a reputable journal.

CHAPTER FOUR

DISCUSSION OF RESULTS

4.1 Sociodemographic Characteristics

A total of 354 students out of 374 students responded completely to questionnaire (response rate 94.7%). The median age was 22years (range 18-32years). Majority of them, 82.5% (292/354) of them were between ages of 20-25years. Second year students made up 42.4% (150/354) of the respondents. Majority of the students in the study, (268/354) were females while 24.3% (86/354) were males.

Table 4.1: Sociodemographic characteristics of respondents in Koforidua, May 2019.

	Number of respondents (n=354)	Proportion (%)
Age (years)		
<20	25	7.1
20-24	257	72.6
25+	72	20.3
Student Group		
Nurse	232	65.5
Medical laboratory science	122	34.5
Year group		
One	81	22.9
Two	150	42.4
Three	123	34.7
Sex		
Male	86	24.3
Female	268	75.7
Religion		
Christian	344	97.2
Islam/Traditional/Others	10	2.8
Total	354	100.0

4.2 Knowledge of IPC among Nursing and Medical Laboratory Science Students (MLS)

Of the 354 students, none of them scored the maximum points of ten nor the minimum of zero points. A total of 1.3% (4/354) scored nine points, 0.85% (3/354) had only one out of ten points. Majority, 84.5% (299/354) scored between four and seven points with the mean score of 5.5 points giving an overall average percentage knowledge score of 44.7%.

On the right point to break the chain of infection, 52.8% (187/354) correctly identified the mode of transmission as the best point of delinking infections. Only 32.5% (115/354) of students correctly chose the underlying premise for standard precautions (SPs) which states all blood, body fluids and tissues are infectious.

Underlying premise of SPs, 41.8% (148/354) wrongly said that both patients and healthcare workers had equal risks of acquiring HAIs. Only 39.3% (139/354) of students correctly identified the use of alcohol hand rub as the recommended way of hand hygiene if hands were not visibly soiled. For hand washing, 41.2% (146/354) of students chose washing hands with water and soap even if hands were not visibly soiled.

Majority of the students, 93.8%(332/354) correctly said examination gloves should be changed after each patient use in agreement with standard guidelines for glove use. For the moments of hand hygiene, 84.5% (299/354) of them had never heard of WHO my five moments of hand hygiene with only 2.5% (49/354) mentioning all five moments.

On waste segregation, only 34.2% (121/354) of students knew that waste was to be segregated at the point of generation by the one who generates the waste as per medical

waste management standard operating procedures. Interestingly 6% (21/354) of students said segregation of waste was no longer necessary.

The following two tables show the responses of students to questions on knowledge in IPC.

Table 4.2a: Knowledge responses of respondents students in IPC, Koforidua, May 2019

	Number of respondents (n)	Proportion (%)
On the disease transmission cycle, focus on		
Reservoir	77	21.8
Mode of transmission	187	52.8
Point of entry	82	23.2
Point of exist	8	2.2
The underlying premise of standard precautions is		
All health workers have the same risk	47	13.3
All exposure incidents must be investigated	44	12.4
All blood, body fluids etc. are infectious	115	32.5
Health workers and patient have same risk	148	41.8
About effective social hand wash		
Keep elbows lower than hands when washing	52	14.7
Wash hands in a basin of water and antiseptic	25	7.0
Wash for at least 30 seconds using hand rub	48	13.6
Apply friction to clean all surfaces	229	64.7
If hands are not visibly soiled		
Wash hands with plain soap and water	64	18.1
Wash hands with an antimicrobial soap	146	41.2
Apply of alcohol-based hand rub	139	39.3
Washing hand with 0.05 hypochlorite	5	1.4
Examination gloves should be		
Changed after use of each patient	332	93.8
should be used for dusting	6	1.7
worn for surgical procedures	11	3.1
worn for handling waste	5	1.4
WHO five key moments for hand hygiene are		
Before touching a patient	7	2
Before clean/ aseptic procedure	4	4.8
After body fluid exposure/risk	8	5.1
After touching a patient	17	1.1
After touching patient surrounding	49	2.5
I don't know	299	84.5
Total	354	100.0

Table 4.2b: Knowledge responses of respondents students in IPC in Koforidua, May 2019

	Number of respondents (n)	Proportion (%)
The TRUE statement regarding segregation of waste in healthcare facility is		
Healthcare workers segregate waste	66	18.6
Waste should be segregated at the point of use	121	34.2
Facility should segregate waste before the final disposal	146	41.2
Not important anymore to segregate waste generated	21	6.0
The following are true about Hospital Acquired Infections (HCAIs) except		
The environment is the major source of bacteria	74	20.9
Health workers are immune to HCAIs	160	45.2
Invasive procedures increase the risk of HCAIs	38	10.7
Acquired even after clean	82	23.2
Indirect contact transmission occurs when germs are transferred between people via objects such as medical equipment, door knobs.		
Yes	320	90.4
No	19	5.4
Don't know	15	4.2
Standard precautions are to be applied when dealing with		
All categories of patients	328	92.7
Only very ill patients	0	0
risks of body fluids exposure	21	5.9
None of the above	5	1.4
Total	354	100.0

4.3 Attitudes of Nursing and Medical Laboratory Science Students (MLS) towards IPC

With regards to attitudes, 77% (227/354) of students scored 4 to using a new pair of gloves for each new patient with 2.3% (8/354) scoring 1 to not using new pair of gloves for new patients. Sixty-five point five percent (232/354) of students scored 4 for adherence to

standard operative procedures reducing risks of contamination with 1.4% (5/354) scoring 1. For decontamination of used equipment, only 15.3% (54/354) scored 4, 50% (180/354) of students scored 3, another 28.3% (100/354) scored 2 and 5.7% (20/354) scored 1.

For the role of vaccination in reducing HAIs among HCWs, 32.2% (114/354) scored 4, 43.2% (153/354) scored 3, with 21.8% (77/354) scoring 2 and 2.8% (10/354) scoring 1.

For decrease of contamination if SPs are adhered to, 59.6% (211/354) scored 4, and 35.9% (127/354) scored 3, 4.2% (15/354) scored 2 and 0.3% (1/354) scored one. The mean attitude score was 3.2 making an average percentage score of 80.5%.

The table below summarizes the mean attitude scores of students.

Table 4.3: Attitudes of respondents towards IPC in Koforidua, May, 2019.

Question	Mean	SD
A new pair of gloves should be used for each new patient visiting the hospital	3.68	0.66
Following standard operation procedures decreases the risk of contamination	3.58	0.65
Decontaminating equipment with 10% sodium hypochlorite for 10 minutes is enough	2.24	0.78
Vaccination decreases hospital acquired infection	3.05	0.81
Adhering to standard precautions decreases the risk of contamination	3.55	0.59
Overall	3.22	0.35

1= very bad, 2=bad 3=good, 4=very good.

4.4 Compliance of Nursing and MLS towards IPC

With regards to compliance to hand hygiene, 44.8% (158) students said they always washed their hands between patient contacts and 6.5% (23) however never washed their hands between patient contacts. Again 55.6% (198) said they used alcohol rub if hands were not visibly soiled, only 4.2% (15) said they never used alcohol hand rub as alternative

to hand washing if hands were not visibly soiled. Another 70.3% (249) always washed their hands after removal of gloves.

For compliance with sharps management, majority of students, 92.4% (327) reported they always put sharps in sharp boxes. The overall mean compliance score was 3.6 giving percentage 88.8% toward IPC. The mean scores were computed for each variable per person on their compliance for each person summarized and shown in the table below.

Table 4.4: Compliance with IPC among of respondents in Koforidua, May 2019

Question	Mean	SD
Wash hands in between patient contacts	3.3	0.8
Use alcoholic hand rubs as an alternative if hands are not visibly soiled	3.4	0.8
Put used sharp articles into sharps boxes	3.9	0.4
Cover wound(s) or lesion(s) with waterproof dressing before patient contacts	3.5	0.9
Wear gloves when exposed to body fluids, blood products, and any excretion of patients	3.9	0.5
Change gloves between patient contacts	3.6	0.7
Wash hands immediately after removal of gloves	3.7	0.5
Mouth and nose are covered when mask is worn	3.5	0.9
Do not reuse a surgical mask or disposable Personal Protective Equipment (PPE)	3.2	1.2
Decontaminate surfaces and equipment after use	3.8	0.5
Overall	3.6	0.3

1=poor 2=sub-optimal 3=satisfactory 4= Optimal.

The figure 4.1 below show the mean percentage scores of knowledge, attitudes and compliance of both nursing and MLS students.

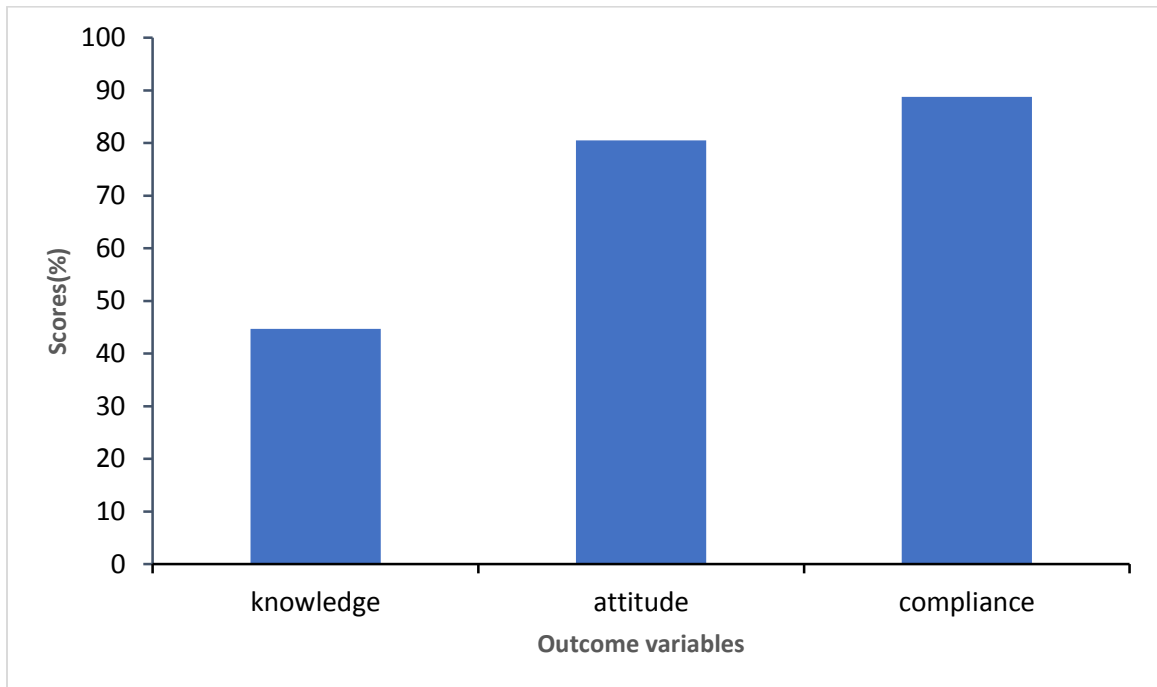


Figure 4.1: Knowledge, Attitudes and Compliance rates of respondents in Koforidua, May 2019.

Kruskal-Wallis tests of differences showed that there was significant differences in knowledge of students across the year of study. Third year students had higher knowledge scores in IPC (p value <0.001). Below a table showing the differences in scores across the independent variables.

Table 4.5: Differences in Knowledge scores of respondents in Koforidua, May 2019

	Knowledge		p-value
	Mean	SD	
Age (years)			0.568
<20	42.6	17.6	
20-24	44.7	13.8	
25+	45.2	16.3	
Group			0.267
Nurse	44.1	15.0	
Medical lab. Science	45.8	13.8	
Year group			<0.001
One	40.4	14.9	
Two	43.2	12.9	
Three	49.2	15.2	
Sex			0.689
Male	44.1	14.5	
Female	44.8	14.6	
Religion			0.594
Christian	44.7	14.6	
Islam/Traditional/Others	42.9	15.8	
Total	44.7	14.6	

Again, Kruskal-Wallis tests for differences in Attitude and Compliance showed a significant difference in attitudes of nursing students and MLS. Third year students had higher attitudes, 82.3% towards IPC compared to, second year students who had average scores of 80.4% and first year's students with scores of 78.0%. This was encouraging since

third year students will soon join the workforce and its best for them to have good attitudes to IPC to help curb HAIS. The tables below show the differences in attitudes and compliance scores of students.

Table 4.6: Differences in Attitude scores of respondents in Koforidua, May 2019

	Attitude		p-value
	Mean	SD	
Age (years)			0.887
<20	81.4	5.1	
20-24	80.4	8.7	
25+	80.6	9.6	
Group			0.030
Nurse	79.7	9.3	
Medical lab. Science	82.1	7.2	
Year group			0.009
One	78.0	10.5	
Two	80.4	8.3	
Three	82.3	7.5	
Sex			0.220
Male	81.5	8.0	
Female	80.2	8.9	
Religion			0.350
Christian	80.6	8.7	
Islam/Traditional/Others	79.0	7.7	
Total	80.5	8.7	

Table 4.7: Differences in Compliance rates of respondents with IPC in Koforidua, May 2019

	Compliance		
	Mean	SD	p-value
Age (years)			0.130
<20	91.9	4.4	
20-24	88.8	7.8	
25+	88.0	8.1	
Group			<0.001
Nurse	90.8	6.7	
MLS	85.2	8.1	
Year group			<0.001
One	91.4	6.3	
Two	86.0	8.1	
Three	90.6	6.9	
Sex			0.002
Male	86.3	9.0	
Female	89.6	7.1	
Religion			0.161
Christian	88.9	7.7	
Islam/Traditional/Others	86.0	7.4	
Total	88.8	7.7	

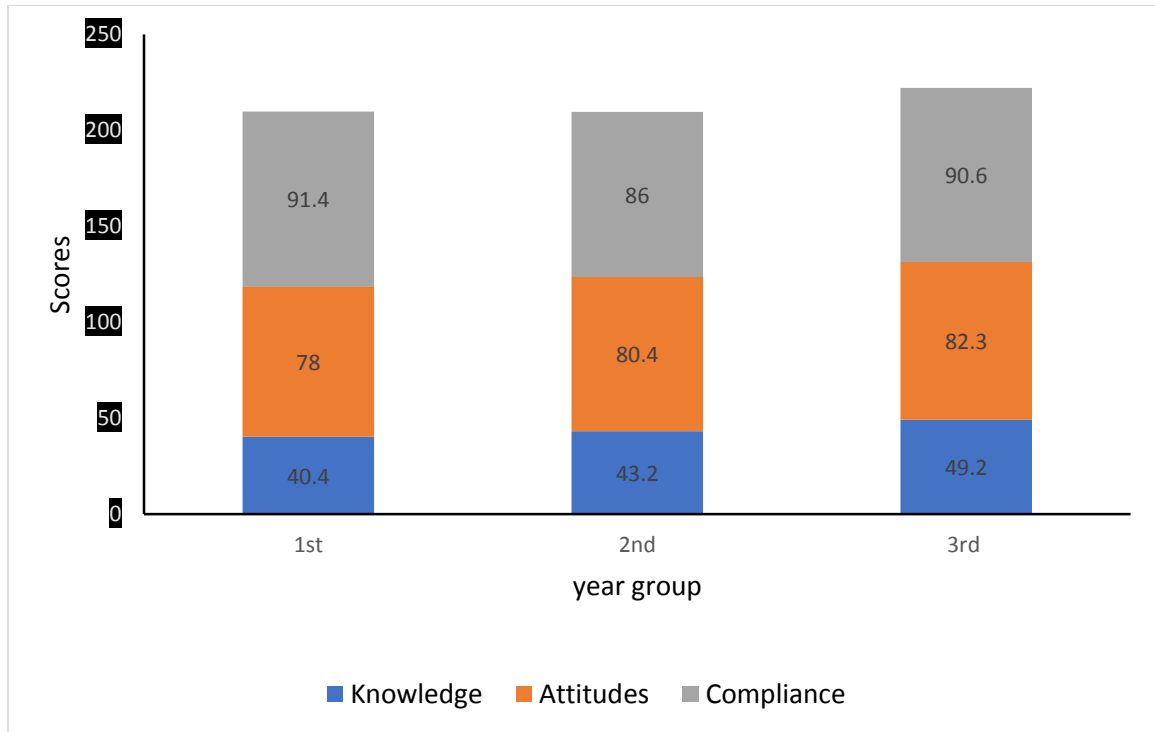


Figure 4.2: Summarized differences in knowledge, attitudes and compliance with IPC of respondents in Koforidua, May 2019.

4.5 Correlations between Knowledge, Attitudes and Compliance of Students

Spearman correlation was used to investigate correlation between Knowledge, Attitude and Compliance scores. Correlation between Knowledge and Attitude was positive and significantly low at about 22% whereas that between Knowledge and Compliance was also positive but low at about 10.9%. This means as knowledge increases, attitudes and compliance also increase but weakly.

Table 4.8: Spearman correlation between Knowledge, Attitude and Compliance of respondents in Koforidua, May 2019

	Knowledge	Attitude	Compliance
Knowledge	1.000		
Attitude	0.220 (p<0.001)	1.000	
Compliance	0.109 (p=0.041)	0.066 (p= 0.214)	1.000

Linear regression was used to investigate the linear relationship between compliance, knowledge, attitude scores as well as demographic variables. For knowledge and attitude, a 1% increase in those scores results in a 0.06% and 0.07% increase respectively in compliance with only that of knowledge being significant even after controlling for other significant variables. There was a negative relationship between age and each of the scores. An older person in the group was more likely to have a 0.31% reduction in the scores compared to younger person. This reduction was however not significant (p=0.063). Medical laboratory students had on average a compliance score of 5.57% less than the nursing students and this was highly significant (p<0.001). This difference reduced to 4.5% which was still significant after adjusting for knowledge, year group and sex. Females had a significantly higher compliance score of 3.3% compared to males but this reduced to just 0.15% after controlling for knowledge as well as course of study and year groups. Variables which were not significant (p>0.05) in the unadjusted state were excluded from the adjusted model. Below is a summary.

Table 4.9: Effect of Knowledge and Attitude on Compliance rates among respondents in Koforidua, May 2019

	Unadjusted		Adjusted	
	Mean difference (95% CI)	P-value	Mean difference (95% CI)	P-value
Knowledge score (%)	0.06 (0.01, 0.18)	0.025	0.06 (0.01, 0.11)	0.031
Attitude score (%)	0.07 (-0.02, 0.16)	0.140	-	-
Age (years)	-0.31 (-0.63, 0.02)	0.063	-	-
Group		<0.001		<0.001
Nurse	Ref		Ref	
MLS	-5.57 (-7.16, -3.98)		-4.50 (-6.50, -2.50)	
Year group		<0.001		<0.001
One	Ref		Ref	
Two	-5.37 (-7.36, -3.39)		-3.11 (-5.23, -1.00)	
Three	-0.80 (-2.86, 1.26)		0.23 (-1.88, 2.34)	
Sex		<0.001		0.879
Male	Ref		Ref	
Female	3.30 (1.45, 5.15)		0.15 (-1.88, 2.19)	
Religion		0.238	-	-
Christian/Islam/	Ref			
Traditional/Others	-2.92 (-7.77, 1.94)			

CHAPTER FIVE

DISCUSSION

5.1 Knowledge of Students in Infection Prevention and Control

This study sought to assess the knowledge, Attitudes and compliance of medical laboratory science students and nursing students in Koforidua. The purpose was to identify areas with gaps that could be addressed to help improve infection prevention and control measures among the students and subsequently reduce the burden of HAIs.

Overall, 92% of the students had poor knowledge score (44.7%), that is knowledge score of less than 70% which was lower compared to that found among students in Namibia where the knowledge score among health sciences students was 67+-2 (Ojulong et al., 2013). The study in Namibia involved university students offering degree programs where entry requirements are usually higher and in effect these students are better positioned to understand and do better in any field of study compared to students in this study who are offering diploma courses in nursing and medical laboratory science. This could explain why they scored higher marks than students in this study.

Again, they have longer years of study, four to seven years and may have more time for the teaching and learning of IPC as compared to the students in this study who spend just three years in school and may not have enough time to place emphasis on the course. Although not significant (p value = 0.267), nursing students had lower scores (44.1) compared to medical laboratory students who scored of 45.8 which was lower than the knowledge scores obtained by nursing students reported by (Asiedu & Adegoke, 2011). Stratifying by year groups, the study showed that third year students were more

knowledgeable than their second and first year colleagues. This was quite different from knowledge scores obtained among dental students in Saudi Arabia where fifth year students had lower knowledge scores compared to third year students by Alharbi et al., 2019). As students stay longer in training, it is believed that they learn more and thus likely to be more knowledgeable, hence it is not surprising that the third year students in this study had better scores compared to second and first year students.

However, there is also the tendency to forget what was taught in earlier years of study as one progresses, especially if those courses were taught only in the first or second years and this could explain the low knowledge scores observed among fifth years compared to third years in the Saudi Arabia study. It is therefore necessary to include IPC in the curriculum throughout the duration of study to help improve knowledge gaps. Also, the lack of knowledge in IPC could be attributed to inadequate lessons and lack of practical sessions in the classrooms as well as inadequate orientation before clinical rotations (D'Alessandro et al., 2014).

More than half of the students knew that the best point to break the chain of infection transmission was at the point of mode of transmission and the premise of standard precaution was that all blood, body fluids and tissues of patients were infectious. This was good because it means students were in a position to take action to prevent themselves from picking up infections during health delivery.

Each day, thousands of patients across the globe seeking healthcare at various healthcare facilities are at risks of healthcare associated infections through the actions and inactions of health workers. Hand hygiene remains the number one means of reducing these risks to patients and must be adhered to by all health workers including trainees (WHO, 2009).

Although hand hygiene remains a major means of breaking the transmission of infections in healthcare settings, many health workers including students do not understand and know the why, when and how of hand hygiene (Ojulong et al., 2013). Again, due to reasons such as effectiveness at killing bacteria, shorter application times, less irritation to the skin and easy availability at all points of care compared to hand washing sinks, WHO recommends the use of alcohol hand rubs if hands are not visibly soiled (Pittet, Allegranzi, Boyce, Health, & World, 2013). The study however found that majority of students still prefer to wash their hands with soap and water even when hands were not visibly soiled. This may be due to lack of knowledge on the current WHO hand hygiene recommendations.

Meanwhile, it's been ten years since the implementation of the WHO guidelines on hand hygiene in healthcare (Sax et al., 2007), but 84.5% of the students either had no idea or said they had not heard about or know of the WHO "my five hand hygiene moments". Of the 354 students, only 49 (2.5%) had good knowledge of the five moments of hand hygiene. This was far lower than what 9% obtained among nursing students and staff in a tertiary hospital at Karad (Shinde & Mohite, 2014).

HCWs usually receive continuous training on current WHO recommendations and this explains why they had better scores than the students. Only 34% of students agreed that waste should be segregated at the point of generation. This was different from findings in Botswana where most of them agreed that waste should be segregated at point of care by the one generating the waste (Mugabi et al., 2018). Again, this is so because healthcare workers receive on the job training and refresher courses on medical waste management compared to students whose main source of knowledge is the classroom.

From the study, medical laboratory students had a slightly higher score in knowledge than nursing students, although this observation was not significant (p value=0.267). Female students were also noticed to have slightly higher scores in knowledge than their male counterparts. And again, this was not significant (p =0.689). These observations were in contrast to previous studies, where there were significant similarities in knowledge scores among males and females, and among medical students and nursing students (Ojulong et al., 2013).

5.2 Attitudes of Students to Infection Prevention and Control

Majority of students (80.5%) had good attitudes towards infection prevention and control measures and was close to 83.9% recorded among Jordanian Nursing students (Darawad & Al-Hussami, 2013). The high attitude scores also resonated with that reported among healthcare workers in Nigeria (Ogoina et al., 2015). The positive attitudes of HCWs in Nigeria was however in conflict with poor attitudes noticed among healthcare workers in Trinidad and Tobago (Unakal et al., 2017) and also among dental students in Central India (Singh & Gupta, 2011).

The poor attitudes noticed may be due to poor understanding of the concept of IPC or even due to inadequate knowledge in IPC. Medical laboratory science students had significantly better attitudes than nursing students (p value=0.030). Also MLS students had relatively better knowledge scores than nursing students and this may explain their better attitudes towards IPC.

Increased in knowledge therefore could enhance students' attitudes towards IPC. In addition, students in their third year of training had higher attitude scores (82.3%) towards to IPC measures compared to their colleagues in the second year (80.4%) and first years

(78%) and this was statistically significant (p value=0.009). This is not surprising because third year students had significantly higher knowledge scores than the second and first year students, thus the better attitude scores. For the attitudes of students by sex, just as was found among stomatology students in Peru, there was no statistical difference among male and female students (Silva et al., 2018).

5.3 Compliance of Students to IPC

The study showed that averagely both group of students had satisfactory compliance rates to infection prevention and control, with about 88.8% average satisfactory compliance scores. These were almost close to the more than 90% scores which is considered as optimal compliance reported by community nurses in resource rich setting in the United States (Addelman, 2018).

The compliance rates by students in this study were self-reported and might have led to over reporting as they were not subjected to an observational research to ascertain the true compliance rates. The scores in the study were also higher than that reported among nursing students in Jordan (Darawad & Al-Hussami, 2013) and that of dental students in Central India (Singh & Gupta, 2011) both of which are resource limited countries like Ghana. From the study, female students were significantly more compliant with IPC measures than their male counterparts (p value=0.002). Females are generally socialized to be extra careful and more inclined towards obeying rules than their male counterparts and this may explain why female students reported higher compliance rates than the male students.

5.4 Correlation of Knowledge, Attitudes and Compliance

Both knowledge and attitudes had a weak positive correlation to compliance as was the case among doctors and nurses in Nigeria, where knowledge was positively correlated to attitudes (Ogoina et al., 2015). Positive correlation between attitudes and compliance to IPC was also reported among nursing students in Jordan (Darawad & Al-Hussami, 2013). When people have positive thoughts and feeling toward certain practices, they are more likely to respect and honour the terms of reference and this may be why there was positive correlation between attitudes and compliance to IPC among students and HCWs.

Again, in the United States, it was reported that certain practices and norms existing in institutions rather than just knowledge had positive correlation to compliance with infection prevention practices (Addelman, 2018). Sometimes being knowledgeable alone may not be enough to conform to best practices. Factors such as availability of resources, existence of monitoring and evaluation systems as well mentoring systems sometimes further lead to compliance than just high knowledge alone.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study showed that both Nursing and Medical laboratory science students in Koforidua poor had poor knowledge levels in infection prevention and control practices. Students in higher years of study were observed to have relative better scores in knowledge than those in lower years of study. These were however still below acceptable levels. This finding is important to planning educational interventions to bridge knowledge gap identified among both student groups as well as all year groups of study.

This study showed however that students reported positive attitudes towards infection prevention and control measures. Third year students had higher attitude scores compared to second and first year students respectively. They also had satisfactory compliance rates with IPC practices. Male students however reported lower compliance rates to IPC.

6.2 Recommendations

To Nursing and Midwifery Training school and Koforidua Technical University

1. Teaching and learning of IPC should be strengthened through the use of multimodal approaches for students in all year groups. This will help address knowledge gaps identified. By understanding and complying with IPC protocols, they will be playing a vital role in reducing the spread of HAIs in healthcare settings.
2. Further research is needed to help explain why male students had lower compliance rates compared to the females.

To the Eastern Regional Hospital

1. There should be compulsory facility based orientation of all students on infection prevention practices before each clinical rotation. This will serve as revision on what was taught in the classroom. These sessions will help students further appreciate IPC in context and thus help improve compliance rates among them.
2. Display of infection prevention and control reminders at vantage points for all students and healthcare workers. These serve as reminders but also serve as source of IPC knowledge for students and may further improve and maintain positive attitudes and optimal compliance rates among students and HCWs.

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APPENDICES

QUESTIONNAIRE

STUDY TITLE: Knowledge, Attitudes and Compliance of Infection Prevention and Control measures among Nursing and Biomedical Laboratory Science Students in Koforidua.

DEMOGRAPHY

Student Group: a. Nurse b. biomedical laboratory Science

Year group: 1. 1 2. 2 3. 3

Sex: 1. Male 2. Female

Age at last birthday.....

Educational Background

1. MSLC 2. Sec/Tech 3. Tertiary 4. Others, specify

.....

Religion

1. Christianity 2. Islam 3. Traditional 4. Others, specify.....

Instruction: The following are multiple-choice questions to assess your knowledge in Infection Prevention and Control. Please circle one best response for each of the questions.

1. On the disease transmission cycle, the most practical point to break the cycle, is to

focus on:

1. Reservoir.
2. Mode of transmission.
3. Point of entry.
4. Point of exist.

2. The underlying premise of the standard precautions is that:

1. All health workers have the same risk of acquiring infections.
2. All exposure incidents must be thoroughly investigated.
3. All blood, body fluids and tissues are infectious.
4. All health workers and patient have same risk of acquiring infections.

3. The following statement is true about effective social hand washing:
 1. Keeping elbows lower than hands when washing.
 2. Washing hands in a basin of water and antiseptics.
 3. Wash for at least 30 seconds using an alcohol-based hand rub.
 4. Apply friction to clean all surfaces of the hand using soap and water
4. If hands are not visibly soiled, which of the following hand hygiene method is the most effective for reducing the number of pathogenic bacteria on the hands of health personnel? Circle the letter corresponding to the single best answer:
 1. Washing hands with plain soap and water.
 2. Washing hands with an antimicrobial soap and water.
 3. Applying 3 to 5ml of alcohol-based hand rub to the hands
 4. Washing hand with 0.05 Chlorine solution.
5. Examination gloves should be ;
 1. be changed after use of each patient whether visibly soiled or not.
 2. Should be used for dusting
 3. Worn for surgical procedures
 4. Worn for handling waste
6. State the five key moments of hand hygiene by the World Health Organization
 1.
 2.
 3.
 4.
 5.

7. Which of the following is TRUE about segregation of waste in healthcare facility?
1. Healthcare workers should segregate waste before taking it to the storage area.
 2. Waste should be segregated at the point of use by the one who generates waste.
 3. Healthcare facility should segregate waste before the final disposal of the waste.
 4. It is not important anymore to segregate waste generated in a healthcare facility.
8. The following are true about Hospital Acquired Infections (HCAIs) except
1. The environment (air, water, inert surfaces) is the major source of bacteria responsible for HCAIs.
 2. Health workers are immune to HCAIs
 3. Invasive procedures increase the risk of HCAIs.
 4. Can be acquired even after seemingly clean procedures such as checking of vitals.
9. Indirect contact transmission occurs when germs are transferred between people via objects such as medical equipment, door knobs.
1. yes
 2. No
 3. I don't know
10. Standard precautions are to be applied when dealing with
1. All categories of patients

2. Only very ill patients
3. risks of body fluids exposure
4. None of the above.

Instruction: The following questions to assess your assess your attitudes to Infection Prevention and Control. Select one that represents your current understanding

11. Do you think that a new pair of gloves should be used for each new patient visiting the hospital?
 1. Strongly Agree
 2. Agree
 3. Disagree
 4. Strongly Disagree
12. Do you believe that following standard operation procedures decreases the risk of contamination?
 1. Strongly Agree
 2. Agree
 3. Disagree
 4. Strongly Disagree
13. Do you believe that decontaminating equipment with 10% sodium hypochlorite for 10 minutes is enough?
 1. Strongly Agree
 2. Agree
 3. Disagree

4. Strongly Disagree

14. Do you think that vaccination decreases hospital acquired infection?

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

15. Do you believe that adhering to standard precautions will decrease the risk of contamination?

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

The following is a Standard Precautions Scale (CSPS) to assess your compliance to IPC during your clinical rotation. Please tick a ✓ in the box that best reflects your current clinical practice.

Please answer all 10 questions.

1. Never 2. Seldom 3. Sometimes 4.

Always

16. I wash my hands in between patient contacts.

17. I use alcoholic hand rubs as an alternative if my hands are not visibly soiled.

18. I put used sharp articles into sharps boxes.

- 19.** I cover my wound(s) or lesion(s) with waterproof dressing before patient contacts.
- 20.** I wear gloves when I am exposed to body fluids, blood products, and any excretion of patients.
- 21.** I change gloves between patient contacts.
- 22.** I wash my hands immediately after removal of gloves.
- 23.** My mouth and nose are covered when I wear a mask.
- 24.** I reuse a surgical mask or disposable Personal Protective Equipment (PPE).
- 25.** I decontaminate surfaces and equipment after use.

Appendix 2: Ethical Clearance